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Compressed Air

DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

VOL. II. NEW YORK, JULY, 1897. No. 5

SCULPTURE WORK BY COMPRESSED AIR.

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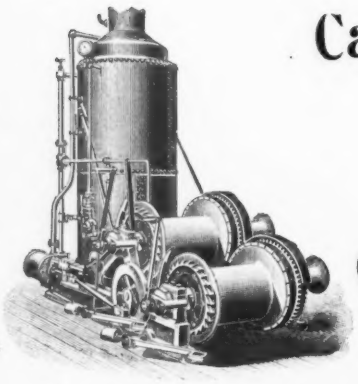

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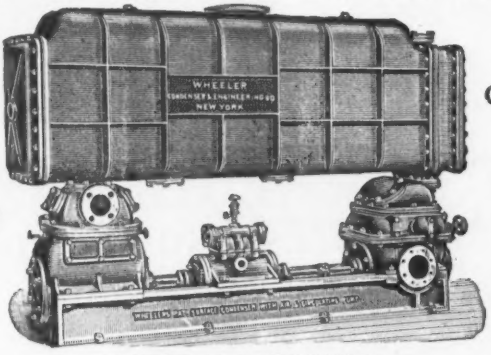

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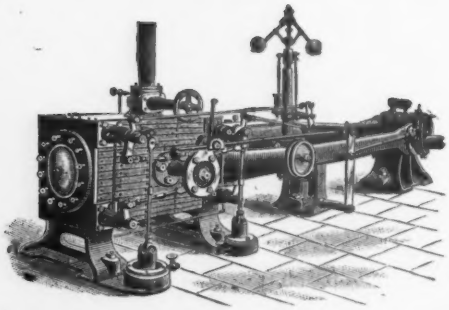

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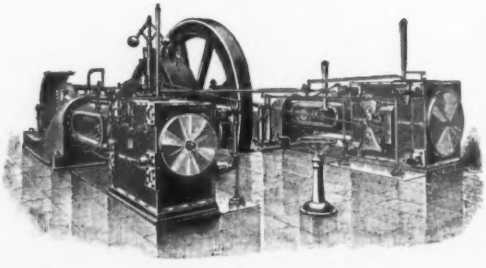

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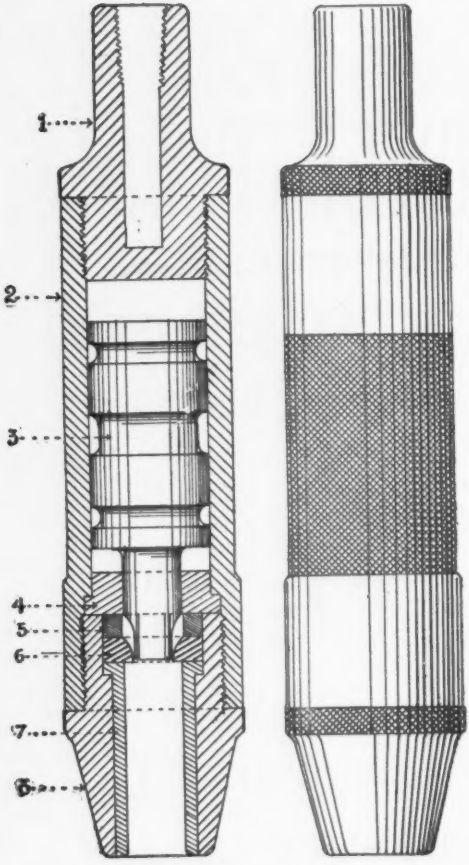

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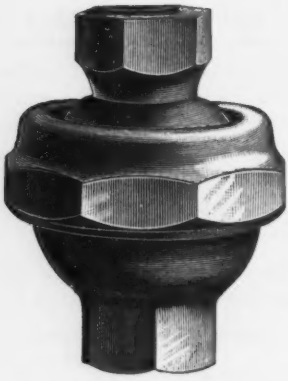

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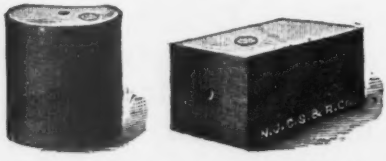

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Compressed Air.

A MONTHLY PUBLICATION DEVOTED TO THE USEFUL APPLICATION OF COMPRESSED AIR.

W. L. SAUNDERS, - - Editor and Publisher
A. E. KENNEY, - - Managing Editor
J. E. QUINTERO, F. C. WEBER, - - - - - Associates

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Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

All communications should be addressed to COMPRESSED AIR, 26 Cortlandt St., New York.

London Office, 114a Queen Victoria Street.

Those who fail to receive papers promptly will please notify us at once.

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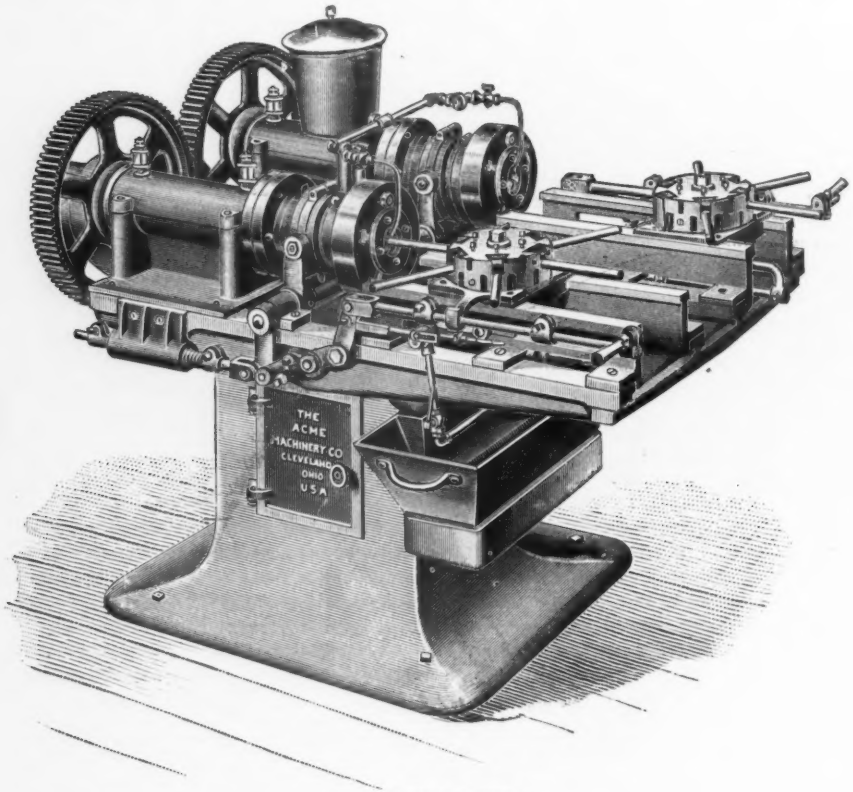
VOL. II. JULY, 1897. NO. 5.

The exhibition of pneumatic appliances at the Master Mechanics' and Master Car Builders' Conventions held at Old Point Comfort, Va., in June, was as usual an interesting display. The various manufacturers of these appliances are doing a good work in promoting the use of air power, and the number and quality of tools on exhibition excelled those of any former year. Practical demonstrations were given of their operations. Portable hoists, tools for punching, shearing, drilling, tapping, reaming, rivetting, chipping and caulking, were shown. Bell ringers, track sanders, car cleaners, bolt-cutting machines, also contributed to make the display complete. While the Master Mechanics and Master Car Builders had excellent opportunities for improving their acquaintance with these modern shop helps at the convention, they also had the privilege of viewing another display of the operation of pneumatic tools at the Newport News Ship Building Yard, which was within easy distance. At this plant a large air compressor supplied air power to twenty-five pneumatic tools of various types. Three large iron battle ships were in course of construction for the United States navy. These war ships are of the most modern design, built entirely of iron and steel. They stand in the stocks with a small army of men busily engaged in putting them together. The plates are cut and punched in the punching shop and are then put in place. It is necessary to punch some 600,000 holes in this work. When the "Illinois," "Kentucky" and "Kearsarge" come out full fledged, we can proudly boast of their having been built by the aid of compressed air. Long lines of hose run from the main supply pipe to the point where the power is needed to operate the tools. Although the upper decks are laid, work is still going on in the holds. Where two holes meet for a bolt to be inserted, they do not always match, a reamer is applied, and the result is that the bolt fits perfectly. There is hardly a difficult job that these tools do not speedily overcome, and the work goes on with great dispatch. A large number of the mechanics visited the works and witnessed the performance of compressed air in one of its most useful applications.

Special attention is called to the communication in this issue from Mr. Henry Fisher, of the Clifton Colliery Co., Ltd., Nottingham, England. Ignition in compressed air pipes and passages should never occur in a properly designed and carefully maintained system, and we believe that a healthy discussion of this subject is needed both in this country and Europe. Should any of our readers differ from us in the statements made in the note following our correspondent's communication, we will be glad to have them express themselves in these columns. We will also be glad to have the experiences of our readers in this line.

Bolt Cutting Machine.

Among the many interesting and novel appliances shown at the M. C. B. and M. M. Convention at Old Point Comfort, Va., in session from June 8th to 18th, was an "Acme Bolt-Cutter" fitted with "Ferguson's Pneumatic Turrets." (See cut.) This machine attracted a great deal of attention from the members of the Conventions on account of the novel use of compressed air, the operator having but to place the bolts in the machine and the air did the rest, carrying the bolt into the threading dies, bringing it out when threaded and throwing the bolt from its position in the machine, leaving the space occupied by the bolt ready for the operator to put in another. These pneumatic turrets are designed to increase the rapidity with which bolts may be threaded, not by altering the speed of the die-heads, but by reducing the time taken to close the dies and remove and replace the bolts, their action being entirely automatic, each bolt being ejected and the blank started in the fraction of a second.



ACME BOLT CUTTER.

In increasing the production of the machine nothing is lost in the quality of the product, as the air pressure while the bolt is threading is beneficial both to the dies and to the thread. The product of the

machine is very large, as will be seen when we say that as many as 7200 of ⅝-in. bolts have been threaded on it in nine hours with one operator.

The makers' name is a guarantee of the quality of the machine, which is strictly first-class throughout. Any further information will doubtless be cheerfully furnished by the makers, the Acme Machinery Co., Cleveland, Ohio.

The Houston Pneumatic Track Sander.

It is a well known fact that the amount of sand used by a locomotive is ordinarily three or four times that which is actually needed to perform the work, as the sand pipes running from sand boxes to rail are one and one-fourth (1¼) inch diameter. Through these run a full stream of sand to the rail, fully 75 per cent. of which leaves the rail before the driving wheels reach it, and is therefore wasted.

Where sand is delivered to the rails by gravity only, you cannot accomplish prompt and quick delivery of sand to rails when wanted.

This device consists of a Siphon and Ejector, simple in construction and easily kept in order. It takes up the sand and forces it with great velocity instantly to the point of contact between driving wheel and rail to either front or rear drivers of any type of locomotive. Distance from sand box to point of delivery can be any distance.

The sand pipes used in connection with this device are very small, being only one-half inch, by which a close discharge and a neat and economical construction can be accomplished.

Sharp angles in the sand pipe do not affect the flow of sand, as the strong air blast forces the sand through them, and to any distance.

The Siphon and Ejector used in connection with this device are especially designed to give the sand a great forward velocity and momentum with a small amount of air.

The sand to both back and front drivers is operated by one valve in cab. This valve is of a very novel construction and is designed so as to regrind itself.

It is claimed that this device will save 75 per cent. of sand in ordinary usage, and much better results have been attained on some roads.

The feature of giving sand to both front and rear drivers from one box is well worth considering.

It can be applied to an engine in six hours by two men, and is applicable to old boxes as easily as to new ones.

The Taylor Hydraulic Air Compressor.

The compressor shown herein was installed for the Dominion Cotton Mills Co., Limited, to furnish power for their print works at Magog, Quebec.

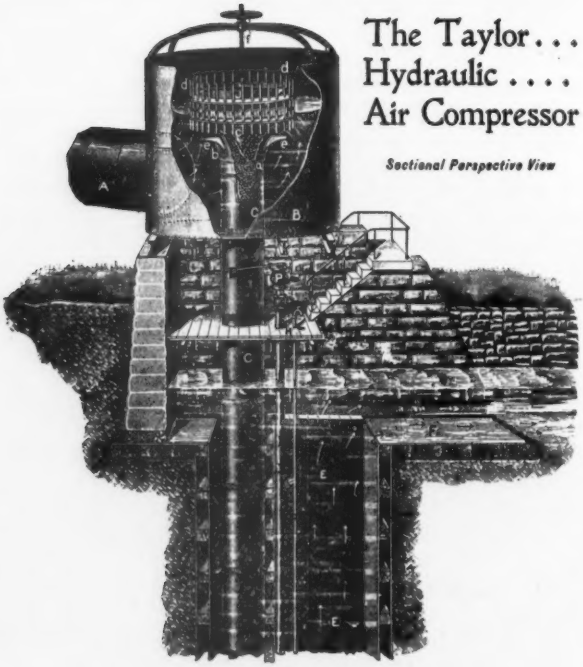
The installation of the machine was attended with much prejudice. The success attained by this plant has, however, convinced all those who doubted the feasibility of the invention. According to tests made on the 7th and 13th August, 1896, by Prof. C. H. McLeod, Ma. E, of McGill University, this compressor gives 62 per cent. of the actual power of the water used, and delivers over 155 H. P. in compressed air. This efficiency is secured in spite of the fact that 20 per cent. of the air is lost because of inefficient separation.

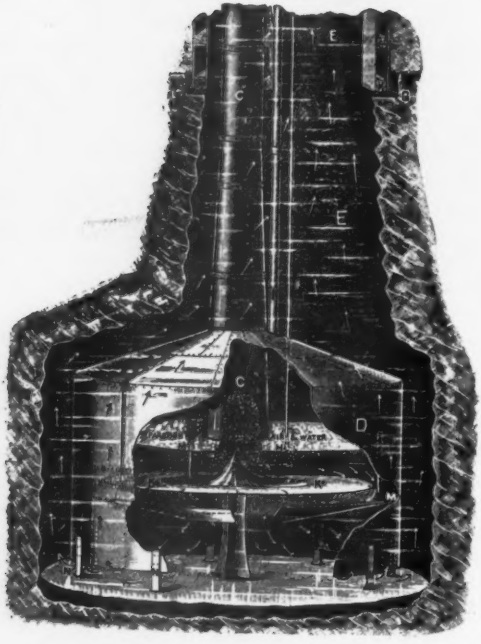
The inventor will undertake in all subsequent installations to obtain an efficency of at least 75 per cent.

The air was first used in the engines on the 12th August, 1896, and since that date it has provided power continuously for *seven* printing machines, each of which is driven by a pair of engines with 8 in. x 12 in. cylinders. It also furnishes power at night for the feed pumps of the boilers, the machine shop, and other purposes. The air pressure uniform at all times, whether supplying one or more engines, is 52 lbs. per sq. inch. The compressor requires no attention other than starting and stopping it.

The Taylor . . .
Hydraulic . . . .
Air Compressor

Sectional Perspective View





DESCRIPTION OF THE HYDRAULIC AIR COMPRESSOR.

The annexed perspective drawing shows a complete compressor, its details being as follows :

A. Penstock, or water supply pipe.

B. Receiving tank for water.

C. Compressing pipe.

D. Air chamber and separating tank.

E. Shaft, or well, for return water. (The required pressure is proportional to the depth of the water in this shaft.)

towards the centre of the compressing pipe.)

e. Adjusting screws for varying the area of water inlet.

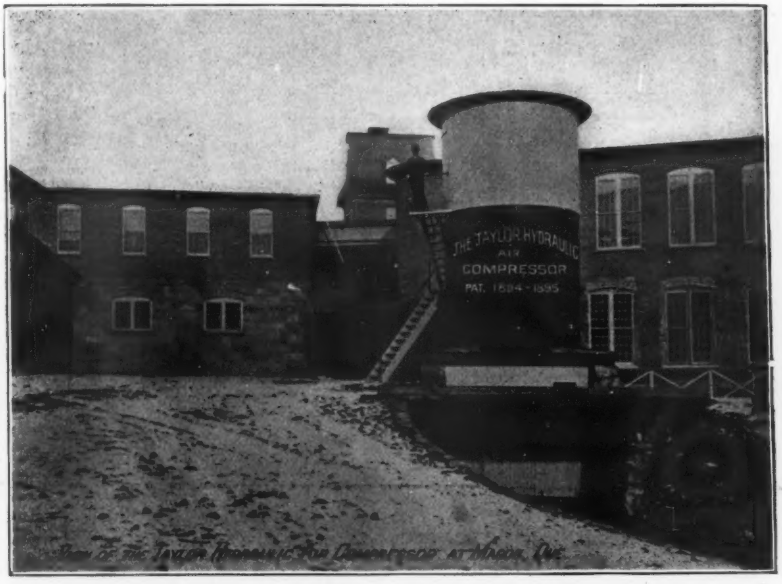
f. Hand-wheel and screw for raising the whole head piece.

K. Disperser.

L. Apron.

M. Pipes to allow of the escape of air from beneath apron and disperser.

N. Legs by which the separating tank is raised above the bottom of the shaft to



F. Tailrace for discharge water.

G. Timbering to support earth.

H. Blow-off pipe.

I. Compressed air main.

J. Head piece, consisting of—

a. Telescoping pipe, with

b. Bell-mouth casting opening upwards.

c. Cylindrical and conoidal casting.

d. Vertical air supply pipes. (Each pipe has at its lower end a number of smaller air inlet pipes branching from it

allow of egress of water.

P. Automatic regulating valve.

WORKING OF THE COMPRESSOR.

The water is conveyed to the tank B through the penstock A, where it rises to the same level as the source of supply. In order to start the compressor the head piece J must be lowered by means of the hand-wheel *f* so that the water may be admitted between the two castings *b* and *c*. The supply of water to the compressor, and consequently the quantity of com-

pressed air obtained, is governed by the depth to which the head piece is lowered into the water. The water enters the compressing pipe between the two castings *b* and *c*, passing among, and in the same direction as, the small air inlet pipes. A partial vacuum is created by the water at the ends of these small pipes, and hence atmospheric pressure drives the air into the water in innumerable small bubbles, which are carried by the water down the compressing pipe C. During their downward course with the water the bubbles are compressed, the final pressure being proportional to the column of return water sustained in the shaft E and tailrace F. The accompanying diagram shows the relative sizes of the bubbles as they descend in a compressing pipe 116 feet in length.

When they reach the disperser K, their direction of motion is changed, along with that of the water, from the vertical to the horizontal. The disperser directs the mixed water and air towards the circumference of the separating tank D. Its direction is again changed towards the centre by the apron L. From thence the water flows outward, and, free of air, passes under the lower edge of the separating tank. During this process of travel in the separating tank, which is slow compared with the motion in the compressing pipe C, the air by its buoyancy has been rising through the water and pipes M, M, from under the apron and disperser, to the top of the air chamber D, where it displaces the water. The air in the chamber is kept under a nearly uniform pressure by the weight of the return water in the shaft and tailrace.

The air is conveyed through the main I, up the shaft to the automatic regulating valve, and from thence to the engines, etc. The air pressure in the main and air chamber increases 1 lb. per sq. inch for each 2 ft. 3½ in. that the water is displaced downwards in the air chamber by the accumulating air. The variation in pressure

from this source will not be more than 3 lbs. per sq. inch in a working plant. As the automatic valve requires a change of only 1 lb. per sq. inch pressure to close it completely, it will be evident that, by properly adjusting the valve, some air can always be retained in the air chamber, and that the water can be prevented from ever reaching the inlet to the air main. If a large quantity of air has accumulated in the chamber, the valve allows of its free passage along the main; but when the air is being used more quickly than it is accumulating, and the pressure decreases below a certain point because the chamber is nearly emptied of air, the valve shuts partially, or completely, adjusting itself to the supply from the compressor.

When the air has displaced the water almost to the lower end of the compressing pipe, it escapes through the blow-off pipe H.

A very practical and simple method of determining the quantity of air used by various pneumatic tools is followed by the United States Metallic Packing Company of Philadelphia, Pa. A belt compressor is run at a fixed speed and as many tools of each size are connected on the compressor as it would maintain under the pressure shown in the column; then taking the total capacity of the compressor and dividing by the number of tools attached to it, the result is obtained. The following table will show the resnlt of a test recently made:

Name of Hammer.	Size of Piston.	Pressure.	Cub. ft. of free air per min'te.	H. P. req'd.
	Inches.			
A. V.....	1 3-16	80 lbs.	13	1.70
B. S.....	1⅛	35-40 lbs.	8	.75
C. S.....	1	35-40 lbs.	4	.3748
D S.....	⅞	35-40 lbs.	3.57	.3345
Other tool about capac'y of A.V.		80 lbs.	26	3.40

Air Hoists.

Compressed air hoists for the purposes that they are designed for have made an enviable record in machine shops, foundries and other places where air is used. Lately we have heard numerous complaints about the service they give when they are indiscriminately applied to shop work. Some have gone to considerable trouble to make the hoist efficient for all purposes, without satisfactory results; one specific complaint being that air admitted to the hoist to suspend a weight at a fixed point for a considerable length of time, does not do it, as the air will leak and the weight will fall. The superintendent of a prominent manufacturing firm writes COMPRESSED AIR as follows:

"Our experience is that all hoists, as constructed at present, are more or less failures because of faulty valves, poor means of operating valves, and pistons mechanically improper for the service in which they are used. We have been a little unfortunate, probably, in our hoists, in the cylinders. They have been bad, and we have been able to repair some of them, but even after that we have not got to the seat of the trouble. We have tried leather pistons, three snap ring pistons, and hardwood ring pistons. The latter gives us the best satisfaction, yet none of them will sustain the heavy load for any protracted length of time. By that I mean for half an hour. This applies to vertical hoists only, as we do not use horizontal hoists. A hoist that will be simple and effective and which will obviate the difficulties experienced by people who are using them, would be appreciated.

"We have also had difficulty in obtaining a coupling on which the hoist will stay, We blow them off about twice a week."

We will be glad to have the experience of others, and will publish suggestions that may be made bearing upon this subject.

COMMUNICATIONS.

Under this heading will be published inquiries addressed to the Editor of COMPRESSED AIR. We wish to encourage our readers in the practice of making inquiries and expressing opinions.

We request that the rules governing such correspondence will be observed, viz: all communications should be written on one side of the paper only: they should be short and to the point.

THE CLIFTON COLLIERY CO. LTD,
NOTTINGHAM, Eng., June 29, 1897.

Editor "Compressed Air":

DEAR SIR:—I notice in COMPRESSED AIR that you invite correspondence from engineers and others interested in compressed air. We have a pair of air compressing engines, cylinders 30 inches diameter by 4 ft. stroke, working at a pressure of 60 lbs. per square inch. The point I particularly wish to bring to your notice is that we have had two explosions in the air cylinders, which is believed to have been caused by the oil used for lubricating the pistons in the cylinders vaporizing and then getting ignited by the high temperature produced by the compression of the air. The oil used was guaranteed to have a flash point of 554° F., and ignition point of 606° F. There have been four other similar explosions with air compressing engines at various collieries in this country. Have you had any other explosions of this kind brought to your notice, and if so, has the cause been made out? If the cause of these explosions could be cleared up it would be very interesting and useful information to users of air compressing engines. If the cause be really due to the oil vaporizing and then becoming ignited, it will be necessary, to prevent explosions from this cause, to use some other material in lieu of oil for lubricating the pistons, or to adopt some other and more effective means of cooling the air during compression, to prevent such high temperatures being produced as will vaporize oil. If you are able to throw any light on this matter, you will greatly oblige

Yours, faithfully,

HENRY FISHER.

Ignition in compressed air discharge pipes and passages is not uncommon in America. At times this ignition is in the nature of an explosion. Two Air Receivers were blown up during the construction of the New York Aqueduct, in one case the engine room was destroyed by fire resulting from this explosion. We have also records of two other cases where spontaneous explosions in the Air Receiver have resulted in the destruction of the engine room by fire. Other instances occur where ignition takes place near the Air Compressor, the pipes becoming red hot at the joints. This ignition has been known to extend into the Air Receiver, and in one instance the flames were carried down into the mine by the compressed air.

In all such cases large volumes of compressed air were used. It is plain that the cause of the explosion or ignition is an increase of temperature above the flash point of the oil which is used to lubricate the Compressor. A thick or cheap grade of cylinder oil should never be used in an Air Compressor. Thin oil which has a high flash point and which is as free from carbon as conditions of lubrication will admit, is the best oil. Our correspondent calls attention to explosions where the flash point of the oil is 554 degrees F., aud ignition point 606 degrees F. We know of an instance where ignition took place with oil which had a flash point of 575 degrees F., ignition point 625 degrees F. Conditions were similar to those mentioned by our correspondent, that is the air was compressed to about 60 lbs. per sq. in. gauge pressure. If the temperature of the air before admission to the Compressor is 60 degrees F., and it is compressed to 58.8 lbs. gauge pressure, the final temperature, where no cooling is used during compression, will be 369.4 degrees F. or a total increase of 309.4 degrees. If air is admitted at 60 degrees F., is compressed without cooling to 73.5 lbs. gauge pressure, the final temperature will be 414.5 degrees F.

and the total increase of temperature 354.5 degrees. Under such circumstances the question naturally arises how is it possible when using oil with an ignition point of over 600 degrees to get an ignition, especially as water jackets and other methods of cooling are used which should reduce the final temperature? The figures are also based on dry air which increases in temperature during compression to a greater degree than moist air, and it is known that air that is used in Compressors is never very dry. The theoretical figures show that in order to get ignition with the oil mentioned, the gauge pressure should be about 200 lbs. per sq. in., where no cooling takes place.

It is plain that there must be an increase of temperature or ignition would not take place. This increase of temperature may result either from an increase of pressure which is not recorded on the gauge, or there may be an increase of temperature without a corresponding increase of pressure. Take the first instance, and it is not difficult to understand that an Air Compressor might deposit carbon from the oil in the discharge passages or discharge pipes which in the course of time will accumulate and constrict the passages so that they do not freely pass the volume of air delivered by the Compressor, hence a momentary increase of pressure might exist in the cylinder heads or in the discharge pipe which leads from the air cylinder to the Receiver; this momentary increase of pressure would surely carry with it an increase of temperature which might exceed the ignition point of the oil. A badly designed Compressor with inefficient discharge passages might produce this trouble. Too small a discharge pipe or too many angles in discharge pipes might also tend to produce explosions. But we have known instances where ignition has occurred in a well designed system, hence we must look for other causes. In our judgment the majority of cases may be traced to an increase of temperature without an increase of pressure; this increase of temperature can only be excessive where the temperature of the incoming air is excessive. A hot engine room from which air is drawn into the cylinder is a bad condition. We have known cases where the incoming air was drawn from the neighborhood of the boiler, the temperature being close to 150 degrees F. This means, of course, that if the total increase of temperature when air is compressed to 73.5 lbs. gauge pressure is 354.5 degrees, the temperature of the initial air should be added to this figure and that the final temperature might be 504.5 degrees.

But we have known ignition to take place when the temperature of the incoming air was normal, when the discharge passages and pipes were free and of ample area, hence we must look for some other cause. The only possible explanation is that the temperature of the incoming air is made excessive by the sticking of one or more of the discharge valves, thus letting some of the hot compressed air back into the cylinder to influence the temperture before compression. When a piston of an Air Compressor has forced a cylinder volume of air through the discharge valve, and when this piston has its direction of movement reversed there will immediately be a tendency of the air just compressed and discharged to return to the cylinder. In this it is checked by the discharge valve, but through long and constant use these discharge valves become encrusted with carbon and are not free to move, hence there may be a moment when one of these valves sticks, or it may not seat properly, in either case there will be some hot compressed air in the cylinder when the piston starts on its return stroke of compression, the air may have lost its pressure, but not its temperature and it is not difficult to uuderstand a leaky discharge valve letting enough air back into thc cylinder to increase the initial temperature to two or three hundred degrees. If so and we are compressing air to 73.5 lbs. gauge pressure we have say 300 degrees tempera-

ture in the free air before compression, aud as the increase is 354.5 degrees, the resulting temperature might be 654.5 degrees.

As a remedy we would suggest more care in selecting the best Air Compressor and in frequent cleaning of the discharge valves and passages. The best Air Compressors are built so that the discharge valves may be readily removed; these valves should be cleaned regularly once a week by the engineer, who should make sure that they fit properly. It is impossible to get good lubricating oil that is free from carbon, hence there will always be more or less carbon deposited on the discharge valves, but this must not be allowed to accumulate.

Inter-coolers between air cylinders and after-coolers between final cylinder and Receiver are also recommended. The best inter-coolers are made of nests of brass tubes, the air passing around the tubes and the water through them, hence there is a thorough splitting up of the air and efficient cooling, One of these coolers located in the discharge pipe will absolutely prevent the passage of flame and will insure the protection of the mine against fire even though there be ignition at or near the air cylinder.—ED.

"Compressed Air."

The volume of discharge of compressed air at terminal pressure from a pipe varies inversely as the square root of the density of the air at initial pressure.

The volume of discharge of compressed air from a pipe decreases whan the initial pressure is increased, and increases when the initial pressure is decreased; the loss of pressure being maintained constant in both cases.

The volume of free air equivalent to the discharge of compressed air from a pipe increases with the increase of the initial pressure, and vice-versa, the loss of pressure being maintained constant throughout.

It is very important in the case of problems relating to the flow of air in pipes to bear clearly in mind whether the flow of free or of compressed air is being considered, as many of the conditions and effects are absolutely reversed in the two cases.

"Free air" does not flow in a pipe, therefore the discharge from a pipe cannot be said to be such or such a quantity of "free air."

It is often said that the loss of pressure in a pipe is proportional to its length. This is true only when it refers to the discharge of air under pressure (not free air) from a pipe. When the equivalent volume of free air discharged is taken into consideration (as is usually done), the loss of pressure caused by friction in the pipe is much greater in proportion as the length increases. Thus, if the loss of pressure at the end of 1000 feet of pipe, with an initial pressure of 60 lbs., is 5 lbs., it will be 20 lbs. at the end of 2500 feet, and not 12½ lbs., which would be the proportionate loss.

WILLIAM COX.

NEW YORK.

We again invite the readers of "COMPRESSED AIR" to contribute to its columns such matter as in their opinion will be of interest. Descriptions of plants using compressed air, are always interesting. The description of new inventions and the illustration of new appliances are also of value. We have benefited inventors and manufacturers of various articles in many ways and information regarding new appliances stimulates inquiry and brings them before the notice of those who appreciate them.

We notify subscribers by postal at the expiration of their subscription. We are always pleased on receiving a renewal of your patronage.

Compressed Air and Electricity at Port Chalmette.

A writer who signs himself "G. F. P.," communicates with the "Railroad Gazette" regarding the Electric Haulage plant at Port Chalmette, La., a description of which was printed in the June number of COMPRESSED AIR.

The above journal has the following to say in regard to his communication:

"We have great confidence in the good faith and good judgment of the gentleman who writes the account of the Port Chalmette enterprise printed on our first page; and it is obvious that he is a good observer. We cannot agree with him, however, that the economy of the electric haulage as 'compared with compressed air has been proved beyond a doubt' at Port Chalmette. The conclusion that the work is done cheaper by electricity is not warranted by the facts presented. It may be correct, but we want more evidence.

"For instance, the statement that the cost of maintaining track under the compressed air haulage is much greater than under electric haulage is, we suspect, theoretical. An experience of about a year with one and half a year with the other, on new track, is not enough to justify so broad a conclusion. If all the details of expenditures on maintenance of track and machinery, of interest on cost of machinery, of fuel and wages account, and of work done, could be gathered, analyzed and compared, the result would be instructive and highly interesting. Until we see such details, however, we suspend judgment on comparative economy.

"Concerning the experience with the compressed air plant, we have some information from another source. The first two air locomotives were furnished by Messrs. H. K. Porter & Co., and were shipped in October, 1895. A third, with greater tank capacity, was shipped in August, 1896. The compressor was furnished by the Norwalk Iron Works. The pipe line was bought and laid by the railroad company, and we understand that the builders of the motors and compressor had nothing to do with the plan of the installation, the capacity of the piping, or the arrangements for storing and charging.

Obviously there were a number of things to be coördinated to get good results. The work of the motors in speed, frequency and loads, the capacity of the compressor, the storage capacity of the pipes, and the points of re-charging should all have been considered. With the work in sight at the outset the first plans were probably good enough. Each motor was expected to make a round trip every half hour and to re-charge directly at the compressor; there were two motors and they charged to a pressure of 600 lbs. per square inch. But the tonnage to be handled quickly developed so as to require three motors, making more frequent trips. For prompt, efficient and economical service there should have been storage capacity enough to equalize the pressure in the motor tanks instantly, or practically so, when connected with the pipe line. There should have been pipes and connections so distributed about the yards and warehouses as to minimize the unprofitable engine mileage in running to and from the charging places. The compressor should have had ample capacity for its work. The fact is that the only provision made for storing air was 1542 feet of 5-inch pipe which gave less than one-quarter the volume of storage capacity necessary to get prompt equalization in the motor tanks. Most of the charging had to be done direct at the compressor, which took anywhere from 12 to 18 minutes, and the compressor did not have capacity to supply air to the three motors at the intervals required.

"It is not surprising, therefore, that the compressed air hauling was unsatisfactory, or that, as we have been told, the motors 'lay down out in the field.' It would not

be surprising, further, to learn that the hauling under these circumstances was costly. Engine crews lost time while running to and from the charging station and while charging from the compressor, and the engines made a heavy percentage of empty mileage. Under all these contrary conditions it would have been surprising if the compressed air hauling had uot been expensive.

"On the other hand, the former Chief Engineer and General Manager, who planned the work and started the compressed air haulage, writing to COMPRESSED AIR, says: 'During my management these pneumatic locomotives gave entire and complete satisfaction These electric motors have about one-third of the hauling capacity of the pneumatic locomotives, are more expensive on account of the fuel consumed, and have the ever-present danger of sparks in a cotton yard.'

"But the difficulties and inefficiencies developed later with the compressed air haulage have nothing whatever to do with compressed air. They, or others quite as great, would arise with any other system as inadequately planned. We do not understand that the Chief Engineer and General Manager, under whose direction the original air plant was installed, is responsible for its inadequacy. We judge that came about chiefly because there was more work to do than had been anticipated. On the whole, from such information as reaches us, this cannot be looked upon as in any way a satisfactory or conclusive test of the relative economy and efficiency of hauling by compressed air and by electricity.

"There is still another consideration which we have never seen satisfactorily dealt with. This place happens to be one where the fire risk is especially great. The principal business is hauling cotton, and the decks on the wharfs and like places are covered with lint. One would say that an electric motor would be considerably more dangerous than a steam locomotive in such a place. Great care must be taken to prevent sparking, and the danger of starting fires by sparks must be constantly great. We have been told that the contract with the electric company requires that there shall be no sparking, and that all rails shall be kept clean at all times, which seems rather a hard condition to carry out. We have indirect information that the motors have really started several fires. On the other hand, our correspondent, who is and has been on the ground in a responsible position, says that there have been no fires attributable to the electric motors. To his testimony, being direct and positive, we must give great weight, but we should say that the immunity must have been secured at great cost in care and vigilance, and we should be very apprehensive of the result if the electric plant were under a management less skillful and faithful."

COMPRESSED AIR.

(CONTINUED.)

(The second paragraph on page 247, June number of COMPRESSED AIR, reads:

CYLINDERS.—Steam Cylinder, 14 inches in diameter, by 18 inch stroke. Air Cylinder, 14 feet 4 inches in diameter, by 18 inch stroke.

This should read: "Air cylinder, 14¼ inches in diameter, by 18 inch stroke.")

Figure 23, illustrates a common type of Duplex Compressor where the steam end is of simple construction, provided with the Meyer valve gear, the cut-off being adjusted by a hand wheel while the machine is in motion. The point of cut-off is indicated by a pointer which moves over a graduated scale. The machine is run with a wide open throttle, being controlled entirely by the cut-off, which is proportioned in accordance with the steam and air pressures. An ordinary ball governor is used to regulate the speed of the engine and to prevent it from running away in case of breakage of air pipes or sudden loss of pressure. Attached to the ball governor manufacturers usually add a pressure governor or regulator which is used to reduce the speed when the air pressure reaches the maximum. Various types of frames are used, some of them of the Corliss pattern; but for the purpose of insuring stability, freedom from breakage, and to resist the sudden strains which are brought to bear during compression, the frames, bearings and fly wheel are usually heavy. The steam and air pistons are in some patterns tied together by a heavy cast iron sole plate and tie rod. The bearings are usually of phosphor bronze, are unusually broad, and are provided with means for taking up wear. The cranks are usually made of wrought iron, and the crank pins, crosshead pin, piston rods, shafts, valve rods, links and pins, and all wearing parts, are of steel, and when possible this is hardened and ground. The

heavy fly wheel gives a smooth, uniform motion, and aids in steam economy by admitting of early cut-off. When running one side of the compressor at a time, the fly wheel prevents irregularity of motion. In this type of compressor the air cylinders are usually fitted with poppet valves, although manufacturers have succeeded in so far perfecting the positive moved valve and the piston inlet that they are applied with economy to the Meyer Duplex machines. The air cylinder is sometimes made of hard brass, owing to the better conductivity of this material, and is as thin as can be made with safety. The cylinders of some machines are provided with jackets for water circulation, and the piston and piston rods are hollow. A telescopic water tube is introduced at the back end of the cylinder, and cold water is supplied to aid in keeping down the temperature during compression. The introduction of cold water in this way undoubtedly reduces the heat of compression, but it is subject to the many disadvantages found in water injection. The water, unless free from foreign matter, is liable to destroy the cylinder, and even when pure it is difficult to lubricate the parts, the water itself being a bad lubricant. This applies to that type where the water passes through the piston and in contact with the walls of the cylinder between the rings and completely around the piston. It is obvious that this leaves a thin coating of moisture in contact with compressed air which is at a temperature much higher than that of the water; and as the volume of air is so much greater in proportion than that of the water, the result is an absorption of the

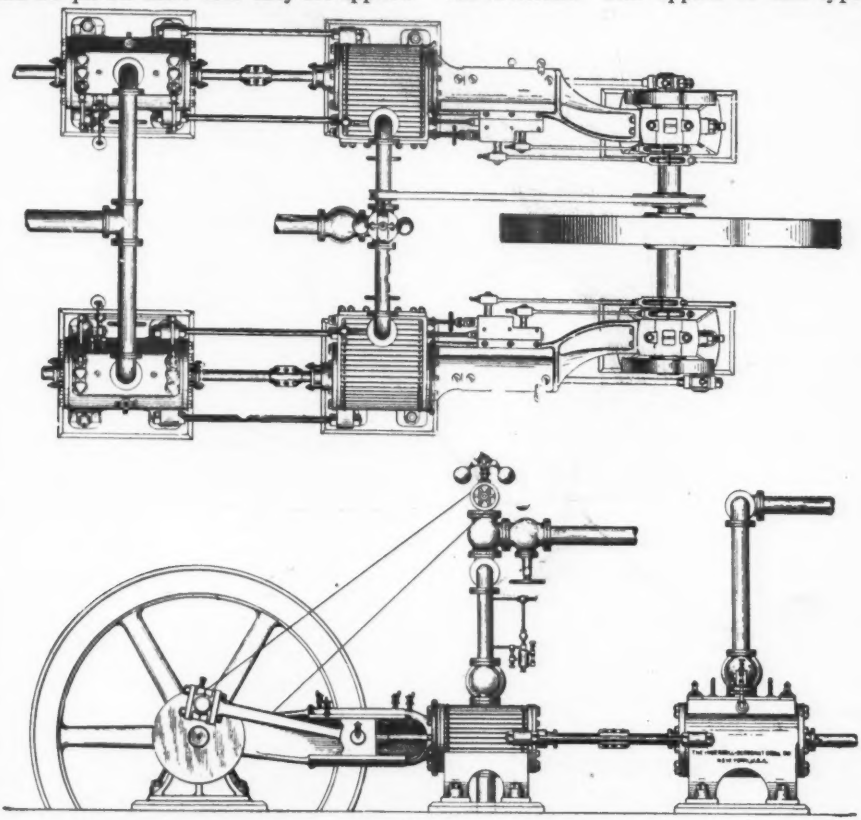


FIG. 23.

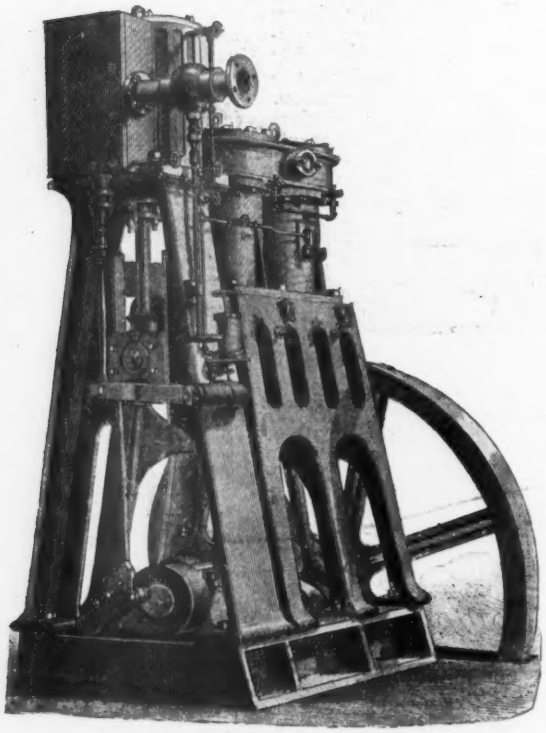


FIG. 24.

water, which goes off into the air receiver in the form of moisture, to be afterwards deposited in the pipes when the temperature of the compressed air is reduced in transmission. It is claimed by the makers that one of their Duplex Meyer Cut-off Compressors was used and tested at Shaft No. 13 on the New York Aqueduct by Prof. James E. Denton of Stevens Institute of Technology, and that it produced a horse power with a consumption of 25 pounds of steam per horse power per hour. A duplex compressor can be regulated so as to run at high or low speeds. It may even stop and start automatically. Where the air is used intermittently—that is, where the use is irregular,—a governor is furnished which will adjust the machine to a slow speed when little air is being used, stop when no air is required, and start again when necessary, thus using the steam only in proportion as the work is done.

The following are specifications of a type of Duplex Meyer Cut-off Valve Compressor:

CYLINDERS.—2 Steam Cylinders, 14 inches diameter, by 18 in. stroke.

2 Air cylinders, 14¼ inches diameter, by 18 in. stroke.

Cylinders made of the best cast iron suitable for this purpose, and of sufficient thickness to safely carry 100 pounds pressure after re-boring once.

PISTON INLET.—Air cylinders of the Piston Inlet type.

WATER JACKET.—Air cylinders and heads provided with water jackets.

FRAME.—Frames of the Corliss Girder type, and strong enough to withstand the severest strain of air compressing work.

BEARINGS.—Main pillow blocks provided with removable shell boxes of best composition metal, accurately bored and scraped to a true bearing surface.

SHAFT.—Main shaft of hammered steel, 6 inches in diameter in the bearings, and 7 inches in the centre, of proper length, turned finished and keyseated, and free from flaws or other imperfections.

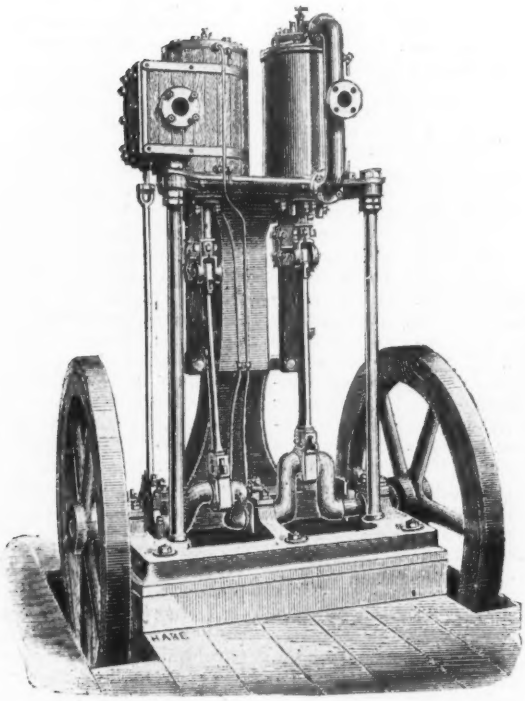


FIG. 25.

CRANKS.—Cranks of the disc pattern, of selected charcoal iron, and of ample strength and proportion for the work required.

FLY WHEEL.—One square rim fly wheel, 8 feet n diameter, with hub bored and key-seated to fit shaft The wheel when finished to weigh not less than 4500 pounds.

VALVE GEAR.—Valve gear of the slide valve type, with Meyer adjustable cut-off.

PISTON RODS.—Piston rods extended through back head of steam cylinders, and attached by means of couplings to piston rods of air cylinders.

TIE RODS.—Air cylinders securely fastened to steam cylinders with tie rods.

GOVERNOR.—A fly ball governor of approved pattern placed in main steam pipe, and driven with belt from main shaft.

LAGGING.—Steam cylinders covered with polished black walnut. Space between lagging and cylinder to be filled with mineral wool.

MATERIAL USED.—Piston Rods, Eccentric Rods, Connecting Rods, Crank Pins, Cross-head Pins and Valve Rods of the best forged steel. Boxes for main crank pins of best composition metal.

THROTTLE VALVE.—Both steam cylinders provided with a throttle valve, with flanges and hand wheel turned and polished.

INDICATOR CONNECTION.—Provision made on both steam and air cylinders for indicator connections.

OILING DEVICES.—Graduating sight feed oil cups for all wearing parts; one sight feed lubricator for each steam cylinder; one Ingersoll-Sergeant Lubricator for each air cylinder.

WEIGHT.—Total weight of compressor ready for shipment, 22,5co pounds.

Figure 24 represents a type of Vertical Compressor which consists of a steam engine connected by means of a crank shaft with two single-acting air pumps, all placed in an upright position. It is compactly built, and is as economical as this type of machine will admit. The cranks are so placed in relation to each other that the greatest power of the engine is applied at the time of greatest resistance in the air cylinders. Water injection is usually applied to these machines, and it is a matter of note that it is in this compressor that water injection has had its longest service, and has given its best results. One reason for this may be found in the fact that the cylinders being placed vertically, are not subject to the wear and destruction

which accompanies water injection machines of the horizontal type. This compressor has been largely used in the western part of the United States for mining service, though of recent years, notably at the Anaconda Copper Mines, it has been replaced by machines of a more improved and more economical type on the pattern of the Duplex Corliss Compound.

Figure 25 illustrates a type of vertical air compressor used in Europe, known as the "Champion." Both the inlet and the outlet valves with their seats are arranged in the cylinder covers; the form of the frame is such that the valves can be readily moved without disturbing the cylinder cover joints. The inlet and outlet valves are provided with very long guides to insure their continued working without damage, and being placed vertically, the wear is more evenly distributed. The air cylinder and outlet valve boxes are surrounded by cold water jackets. The general construction of the machine is so clearly shown in the illustration that further description is unnecessary.

The experience of American manufacturers, which has been more extensive than that of others, has proved the value of direct compression as distinguished from indirect, as shown clearly in this type of machine. By direct compression is meant the application of power to resistance through a single straight rod. The steam and air cylinders are placed tandem. Such machines naturally show a low friction loss, because of the direct application of the power to the resistance. This friction loss has been recorded as low as 5 per cent., while the best practice is about 10 per cent. with the type which conveys the power through the angle of a crank shaft to a cylinder connected to the shaft through an additional rod.

W. L. SAUNDERS.

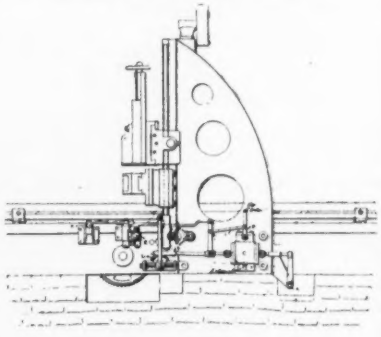
Pneumatic Planer Feed.

There has been patented recently by Alexander Gordon, president of the Niles Tool Works Co., Hamilton, Ohio, an application of air in the operation of planing machines which will be of advantage to that type of machines and add to their efficiency. In this device the feed is actuated by air. It is positive and reliable, and has a very wide range. A quicker return than ordinarily obtained is desirable. By operating clutch pulleys by air, any desired speed is obtained, with mechanism which is very simple, has few parts, and none subject to excessive wear.

We illustrate herewith this pneumatic feed and quick return. The air is taken from the compressed air supply, such as is now in use for general machine shop purposes, or from a small pump that may be attached to the machine in any convenient position, and be driven by a belt from the countershaft. It is carried from the pump or compressor through a suitable pipe to air cylinder which controls the feed and driving clutch mechanism.

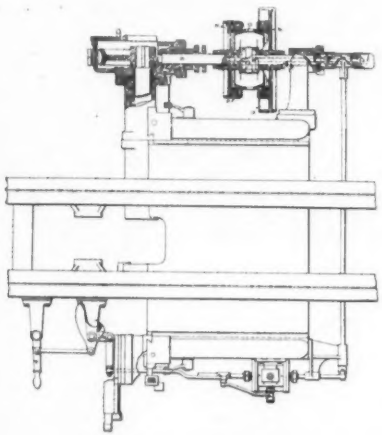
A specially constructed valve admits it to the cylinder. This valve is operated through simple connections, fully shown in the drawings by the shifter arm and reversing tappets on the planer table. When the table carries the tappet or dog against the reversing lever, instead of shifting the belts, as in the ordinary planer, it moves the valve lever controlling the uir admission to the cylinder. This instantly throws the piston in the cylinder to the opposite end, carrying the rack to which it is attached forward or backward to operate the feed rack. At the same moment the clutch operating the worm shaft is thrown over and the direction of the table motion is reversed. This shifting arrangement is simple and efficient.

By examining the drawings it will be noticed that the piston rod is carried through the cylinder toward the back of the planer and is connected to a lever. The opposite end of this lever is attached to a rod running across and under the bed to the worm shaft. On the worm shaft end of this rod is a segment gear whose teeth work into a short rack. The rack is attached to a rod which moves the central member of the clutch from one pulley to the other, and the pulleys are operated one by straight and one by cross belt.



PNEUMATIC PLANER FEED.

Fig. 1 shows the clutch pulleys, bearings, sleeves and casing in section, exposing the clutch shifter rod in the interlor of the worm shaft and clearly showing the various features of these parts. The belts run continuously in one direction, thus preventing the excessive wear due to shifting, to overcoming momentum of pulleys and other parts, and to the rubbing of the edges of the belt in the shifter eyes. The belts can be made as wide as the necessities of the case require, not being limited by any of the conditions always prevailing in other planers. The clutch, from its peculiar construction, holds most tenaciously under very slight pressure, and is quite easily released.



PNEUMATIC PLANER FEED.

No adjustment is require l in keeping the clutches in working order, as they will do their duty until the wood facing is entirely gone, and the replacing of this facing or lining will not cost nearly as much as the repairs to and the replacing of belts.

This is an effective machine for variable speeds, as the pulleys controlling the cutting speed can easily be made cones and belt shifted, as on a lathe. The pulleys operating the return stroke could also be made in this manner, and the speed increased or decreased, as the piece being planed was very heavy or very light. The return may be made 6 or 8 to 1, with air cushions positively preventing all shock.

A number of these planers, from 30 x 30 to 10 x 10 inches, are in successful operation at the Niles Tool Works, and a 54-inch planer, for planing locomotive frames, with 35-inch traverse of table, is now under construction. The quick return on this planer is especially desirable by reason of its length and the comparatively slow speed of the cut.

—Iron Age.

Recent Patents on Pneumatic Appliances.

CONDENSED FROM THE OFFICIAL GAZETTE OF THE UNITED STATES PATENT OFFICE.

No. 584,146—Air Storage Motor Car—Robert Hardie, Rome, N. Y.; assignor to General Compressed Air Company, New York, N. Y.

A motor with air storage reservoir wherein air is stored at comparatively high pressure, and an air engine wherein the air is used at comparatively low pressure.—It provides for an automatic regulator or reduction valve, which controls the air passing it from the storage into the working system. It consists of an air storage motor car, storage reservoirs, driving engines, reduction valve, hot water air reheater and brake motor, a check valve in the working pressure pipe, and a combination valve controlling the brake motor and the starting connection. Now in use at the Third Avenue Company's line at 125th street, New York.

No. 584,220—Pneumatic Handle—Seward M. Gunsaul, Omaha, Neb.; assignor to the S. M. Gunsaul Co., same place.

An improvement in bicycle handles, consisting of a casing of flexible elastic air-tight material over tubular handle bar and a nut secured in the end of it. It forms a flexible air-tight handle casing.

No. 585,090—Air Compressing Apparatus. Isaac T. Dyer, Chicago, Ill.; assignor, by direct and mesne assignments, to the Dyer Power Co., same place.

No. 585,498—Pneumatic Despatch Apparatus. B. C. Batcheller, San Francisco, Cal.

For transmitting letters and parcels from one point to another.—This system is to be installed very shortly, affording communication between the New York and Brooklyn Post-offices, and will probably be extended throughout both cities.

No. 585,503—Pneumatic Spraying Machine. John Black, Nelson, New Zealand. Filed Feb. 12, 1897. Serial No. 623,098. (No model.)

The Only Sanding Device

HOUSTON SANDER.

Giving Sand to both Front and Back Drivers. . . . .

No change in Sand Box Saddle when applied to Old Boxes . . .

No delay to Engine for it can be applied in six hours.

Delivery Pipes Only One-Half Inch.

Descriptive Circular on Application.

Western Ry. Equipment Co.

ST. LOUIS, MO.

TO those using compressed air in their works, it will probably be a matter of interest, to know, that we are now selling for (**$50**) **Fifty Dollars Net a Complete Whitewashing and Painting Machine,** for using one nozzle, of the same capacity, as those used in spraying **"Red Lead Paint"** on the Iron work of the New U. S. Appraiser's Stores in this City. As an item of information we will say, the entire expense for doing this work was less than would have been the cost of Brushes to do this same work! and the work is better done than could have been done by hand—for further information write to

TURNER MACHINE CO.,
35 W. 14th Street, New York.

THE WOLSTENCROFT

PNEUMATIC TOOL CO.,

(FRANKFORD) PHILADELPHIA, PA.

Manufacture Pneumatic Tools as follows:

Size Diameter Hammer.

¼ inch for fine Carving on Onyx and Soft Stones.

⅜ " " fine Carving on Granite and Marble.

½ " " " " " " " "

⅝ " " sunken letters" " " "

¾ " " raised " " " " "

1 " " roughing around letters on Granite and Marble.

1¼ " " heavy cutting on Granite, Blue Stone " "

1⅜ " " chipping and caulking bath boilers and light tank work.

1½ " " beading boiler flues, chipping and caulking locomotive tenders and portable boilers,

1⅝ " " heavy boiler caulking and metal chipping; also for use in scaling armor plates.

1¾ " and 2 inch. diameter hammer Tools, made on order,

The Patents under which the above Tools are manufactured, have been sustained by the United States Court.

TOOLS SENT TO RESPONSIBLE PARTIES FOR 30 DAYS TRIAL.

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United States Metallic Packing Co.,

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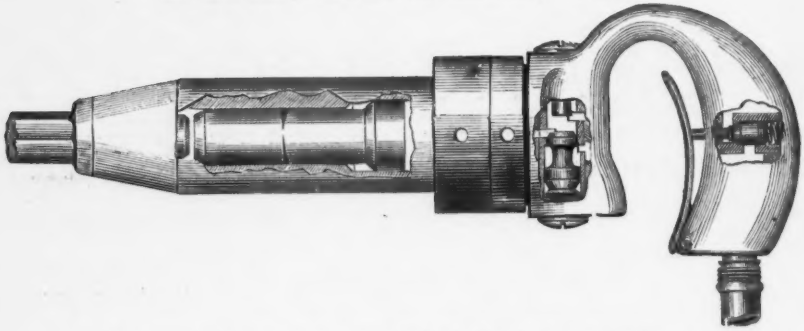

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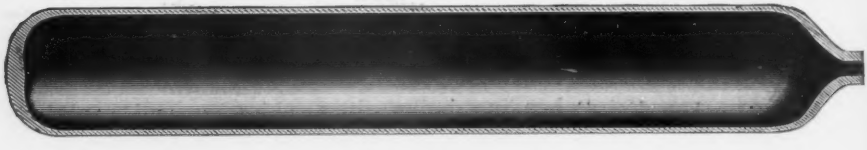

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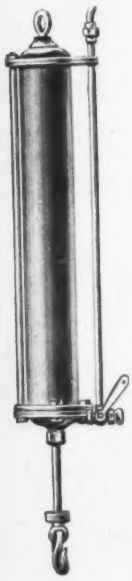

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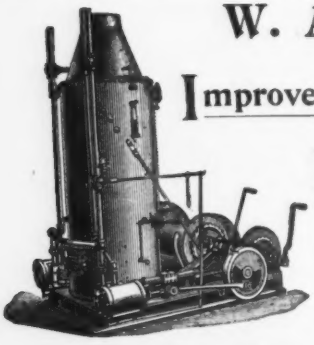

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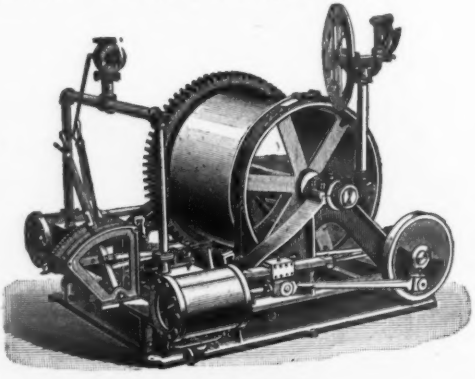

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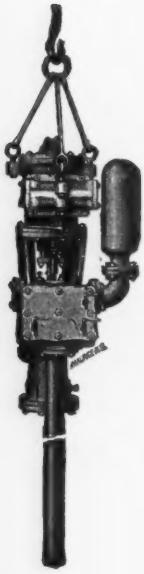

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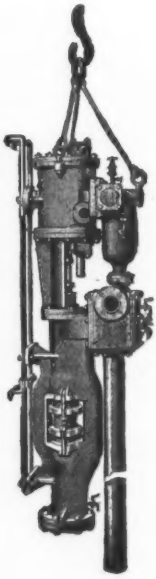

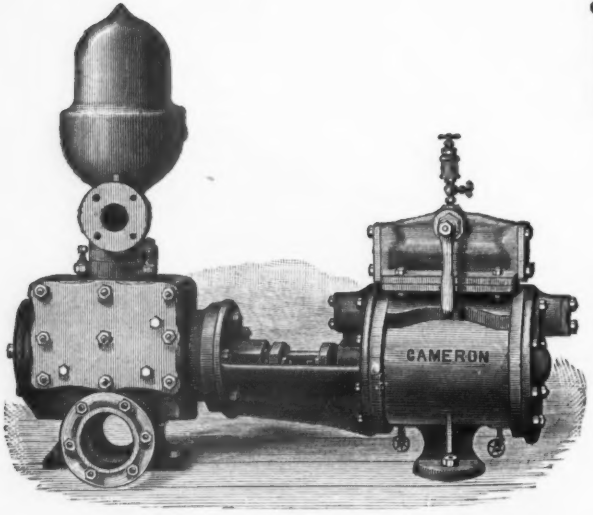

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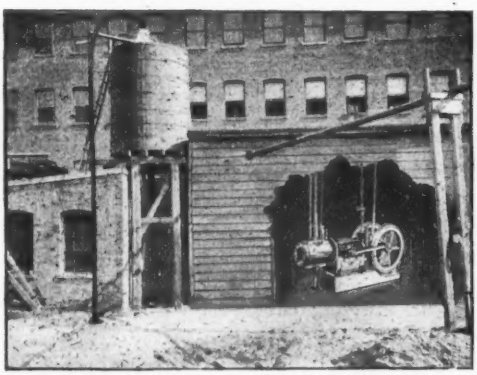

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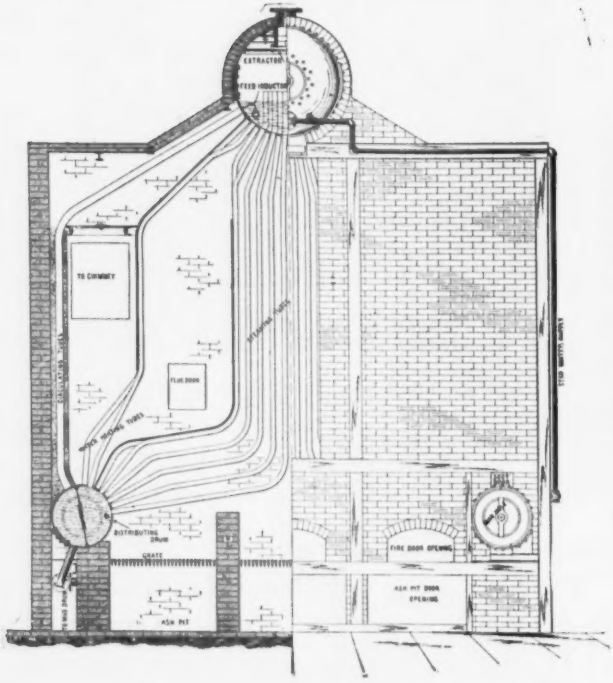

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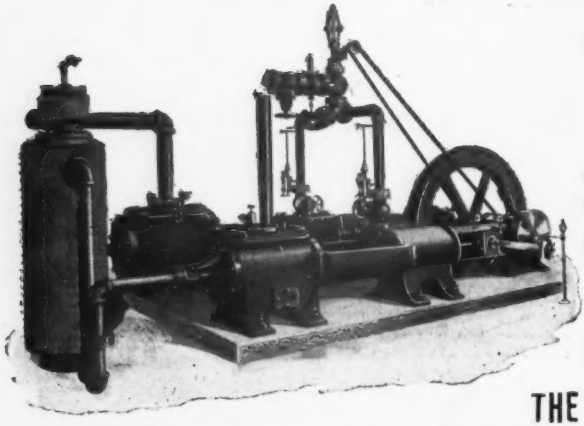

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